iron with raw or coked brown coal, and that the practical difficulties have been partly solved; for we learn that at Kalan a blast-furnace was for a time worked with a mixture of from 25 to 75 per cent. of brown coal, and 25 to 75 per cent. of coke. The great difficulty in the utilisation of this fuel lies in the fact that, owing to the high percentage of contained water, the raw coal is liable, when heated, to splinter up into small pieces, somewhat similarly to anthracite, and the coke formed of it is also very small and tender. It is, however, satisfactory to learn from Prof. Tünner that these difficulties may be in a measure obviated by the use of a strong blast, and especially constructed furnaces. The chief difficulty arises in continuing the operation when sponge-iron is produced; but it is suggested that the reduction might be completed from this stage in a small furnace, such as a Siemens furnace with coked fuel.

The results of the further labours of the Committee will be awaited with great interest.

Mr. G. J. Snelus of Workington contributes a paper on the Distribution of the Elements in Steel Ingots. It was till quite lately taken for granted that the steel plates, &c., produced from ingots were not only mechanically, but chemically homogeneous. When the disastrous failure of the boiler plates of the *Livadia* took place, this subject, amongst many others, was minutely investigated, and samples of different portions of the plates were submitted to chemical analysis, with the startling result that the proportions of carbon, manganese, phosphorus, and sulphur were found to vary greatly. At the spring meeting of the Institute Mr. Stubbs announced, during a discussion, that he had discovered that during the solidification of the ingots a redistribution of the elements took place, the carbon, sulphur, and phosphorus going to that part which remained fluid the longest. Mr. Snelus has now by experiment confirmed this statement so far as large ingots are concerned. This fact is brought out most clearly in the following table, which gives the analysis of carbon, sulphur, and phosphorus, of six samples taken from a slice 21 inches below the top of an ingot, measuring 7 feet × 19″ × 19″, and a similar number from a slice 4 inches above the bottom; the number in each case being taken from the outside, number 6 from the centre, and the remaining numbers from intermediate positions:—

No.	Top.			No.	Bottom.		
	C. carb.	Sulphur.	Phosph.		C. carb.	Sulphur.	Phosph.
1.	·44	·032	·044	1.	·44	·048	·060
2.	·54	·048	·060	2.	·42	·056	·062
3.	·57	·080	·086	3.	·41	·048	·054
4.	·61	·096	·097	4.	·40	·048	·054
5.	·68	·120	·111	5.	·38	·048	·058
6.	·77	·187	·142	6.	·37	·044	·052

In examining smaller ingots, however, Mr. Snelus found that the metal was practically homogeneous, and consequently the want of uniformity in the *Livadia's* boiler plates cannot be accounted for in this way, seeing that they were produced from relatively small ingots.

Mr. Edward Richards gave an account of a series of experiments on the strength of samples of mild steel. The specimens were tested both for ordinary tensile strength, and also for the tensile strength after the samples had been submitted to long-continued tensile and compressive strains approaching the elastic limit to torsional strains, and to long-continued strains below the elastic limit. He also made experiments on the strength of samples of plates which had been perforated. The results are of great interest, and will well repay careful study, though they are too voluminous to be reprinted here. We may however notice that in one sense these experiments go to support the much-combated opinion held by Dr. Siemens, that any mechanical treatment to which mild steel is subjected, has invariably the effect of increase of strength.

THE "QUARTERLY REVIEW" ON EARTHQUAKES

THE pages of the *Quarterly Review* constitute perhaps the very last place in which one would look for a new theory on an important scientific question, and the perusal of an article in the July number of that journal on "Earthquakes: their Cause and Origin," has left us in grave doubt as to whether the author of it is writing seriously or is perpetrating a gigantic practical joke.

The article professes to be a review of the well-known and valuable works of Schmidt, Heim, and Mallet on Earthquakes; but added to this list of books for review we have "Scepticism in Geology, and the Reasons for it, by Verifier"! When we find that a considerable portion of the article is occupied with passages quoted from this last-mentioned book, in which the most absurd misconceptions and misconstructions of the writings of Lyell, Darwin, Huxley, and others are embodied, we can scarcely forbear from leaving the task of framing an hypothesis concerning earthquakes, in order to indulge in conjectures as to the relations which may possibly exist between "Verifier" and the author of the article in question.

Ignoring the whole body of facts which have been accumulated by seismologists concerning the amplitude, direction, and velocity of earthquake-waves, the author denies that the earthquake movements are waves at all; and in his reasoning (if such it can be called) he hopelessly confuses the vibration with the shock which has produced it. Dismissing with contempt the views of others on the subject, he proceeds to offer his own conjecture as to the cause of earthquakes. It is no other than our old friend electricity, written with capital letters. Some well-known examples of electrical discharges taking place from portions of the earth's surface are adduced, and it is then naïvely assumed that such discharges of terrestrial electricity would produce the effect of an earthquake. The undulatory movements are supposed to be the result of a struggle of the electricity to break through cushions composed of soft, non-conducting materials, and the cracks and chasms opened in the soil to the power of the "electric jet" to rip asunder the surface.

The facts on which this extraordinary theory (or "conjecture," as the author very properly terms it) appears to be based are of two kinds. In the first place it is noticed that peculiar atmospheric and electrical disturbances have occurred at the same time as earthquakes. In the second place Dr. Schmidt is quoted to prove that the earthquake shocks which he had studied in Greece had very commonly a course from north-east to south-west. The author adds to this the fact that an earthquake-wave occurring in the United States in the year 1870 took the same direction. He then asks triumphantly, "Is not this the line of path habitually followed by electric currents?"

Excited beyond all bounds by this supposed discovery of the true cause of earthquakes, our author then proceeds to make a number of suggestions which are certainly rather sensational than practical. To the Society of Telegraphic Engineers he appeals to invent a conductor which shall ward off the electric currents and divert earthquakes from their habitual haunts. Medical men are requested to examine the bodies of people killed during earthquakes in order to discover "lightning-scars." And lastly, Sir William Thomson and other eminent electricians are asked to "direct their attention to that storehouse of unlimited energy already filled within the bosom of the earth," and to utilise it for useful purposes.

This curious article may at least serve one useful purpose. Its author is evidently a man of some general knowledge and considerable culture, and the absurd errors into which he has fallen are manifestly the result

of his never having received any proper training in the rudiments of science. If the appearance of this article serve to call the attention of the managers of our public schools, and others interested in education, to the painful consequences which may result from the want of a preliminary grounding in the facts of science and the principles of scientific reasoning—then we think it will not have been written in vain.

THE STORM OF FRIDAY, OCTOBER 14

THIS great storm, which appeared so suddenly, sped its course over North-Western Europe so rapidly, and involved so wide a region in its destructive violence, will be long remembered for the well-nigh unparalleled loss of human life which it has occasioned among our fishing population between the Forth and the Tweed. For some days previously atmospheric pressure had been low to the north of the British Isles and high to the south, the difference from north-west to Land's End being about an inch, thus giving steep gradients, and resulting strong west and north-west winds, and stormy seas along the west coast; and as the area of low pressure moved very slowly eastwards the weather conditions continued with some persistence substantially the same. At length on Thursday morning the daily weather charts showed that a change had just begun in the extreme south-west of Ireland, at Valentia, where, and where only, with a barometer beginning to fall, the wind had changed to a southerly direction, but everywhere else in the British Islands it remained north-westerly; whilst at the same time the area of high pressure to the south was advancing from France to Spain, indicating that the path of the coming storm would take a more southerly course. By 2 p.m. the area of a falling barometer had spread eastwards, and the wind changed to south-west as far as Holyhead; and by 6 p.m. observations showed the continued rapid easterly advance of the storm, the wind being now southerly or south-westerly at all the telegraphic stations except Nairn, where it was west-north-west, showing that Nairn was still within the influence of the slow-moving depression to the north.

High winds and very heavy rains occurred during the night over the northern half of Great Britain, and on Friday morning the weather charts showed that North-Western Europe was involved in a storm of great intensity, the centre of which had now advanced as far as Midlothian. Gradients were steep all round the low centre of pressure, and consequently gales and storms of wind prevailed in all parts and in all directions over the British Islands, being west over France and the south of England, south-west and south over the north of England and the North Sea, north-east in the northern half of Scotland, and north-west in Ireland. From the barometric readings published in the *Times* it is seen that the lowest reading occurred in London about 8 a.m., and, in accordance with the isobars on the Weather Chart, the lowest reading occurred in Edinburgh at the same hour. In London, which was some distance from the centre of the storm, the lowest barometer was only 29·086 inches, but in Edinburgh, over which the centre passed, pressure fell to 28·425 inches, which was an inch lower than it was twelve hours before. After 8 a.m. a rapid recovery of pressure set in; the most rapid rise of the barometer in London was 0·214 inch in the two hours from 4 to 6 p.m., and 0·163 inch in the two hours immediately following. In Edinburgh the increase proceeded at a much more rapid rate, beginning with 0·018 inch, from 8 to 9 a.m., and increasing gradually to 0·166 inch from noon to 1 p.m., and 0·150 inch from 1 to 2 p.m., after which it rose less rapidly, and continued to do so at a steady, though greatly diminished, rate for two days till Sunday at 10·30 a.m., when the barometer stood at 30·370 inches, having thus risen nearly two inches in little more than forty-eight hours.

On Saturday morning the centre of the storm had advanced fully 600 miles to eastward, being at the high daily average of 25 miles an hour, and was now near the south-west angle of Lake Wener in Sweden. Here the lowest barometer was about 28·600 inches, whilst at the same time to westward at Valentia pressure had risen to 30·220 inches, thus giving for the southern shores of the North Sea steep gradients for north-west winds, which, with the high seas they raised, proved very destructive to those coasts.

The anticyclone indicated by the high barometer following in the wake of the storm was accompanied with temperatures unusually low for the season during the night of Saturday–Sunday, when temperature fell to 27°·0 at Parsonstown and Nottingham; 29°·0 at Ardrossan; and 32°·0 at Leith, Shields, Cambridge, Oxford, and Mullaghmore. Snowfalls of some depth occurred in many districts, doing no little damage to green crops, and in later districts to grain crops still standing in the fields.

The lamentable destruction to fishing-vessels off the coast of Berwickshire was doubtless to no inconsiderable extent due to the deceptive character of the weather on Friday morning in cases where the barometer either is not consulted, or such a fall as an inch during the twelve hours immediately preceding, is discredited as a precautionary warning. In Midlothian, shortly after eight o'clock, the clouds broke up and the sun shone in a sky rapidly clearing of clouds. Soon, however, a change commenced, and within an hour, behind a low bank of darkish-looking clouds in the northern horizon, a long bank of ashy, leaden-hued, ominous clouds began to appear, and rose higher in the sky. In a brief space of time the whole of the sky was overcast, and a darkness quickly followed so great as to render gas necessary in reading the morning newspaper. It was remarked at the time that the darkness lasted three or four times longer than is usually the case with the darkness which is observed immediately to be followed by a complete change of wind. When it passed away, the wind had changed from south-west to north-north-east and the temperature fallen, and thereafter the wind gradually rose to a gale. On the other hand, off the Berwickshire coast the darkness was denser and more threatening, and almost simultaneously with its approach a hurricane broke out with a devouring energy which bore everything before it, and, explosively as it were, instantly rose to a height which, judging from actual facts related by the fishermen who escaped and the spectators on the shore, can perhaps only be paralleled in this country in recent years by the Edinburgh hurricane of January 24, 1868. On land many lives were lost in London and elsewhere, and in all parts of the country chimney-stacks, roofs, and walls were blown down, telegraph lines were wrecked, and tens of thousands of the finest trees were snapped asunder and levelled with the ground. When there has been time to collect the records of this storm, it will be found to have been one of the most destructive to life and property in these islands in the memory of the present generation.

THE INTERNATIONAL EXHIBITION AND CONGRESS OF ELECTRICITY AT PARIS[1]

IV.

AS we believe our readers will be interested in a fuller description of the arrangements for the telephonic hearing of the Opera than we have yet given, we extract the following from Nos. 50 and 51 of the new and popular French electrical journal, *La Lumière Électrique*, edited by Count Du Moncel. It is from the pen of the Count

[1] Continued from p. 564